IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/738,465	Examiner: Krishnan S. Menon
Applicant: **Scott Sibbett**	Group Art Unit: 1723
Filed: December 17, 2003	Confirmation No.: 9547
For: **SIEVING MEDIA FROM PLANAR ARRAYS OF NANOSCALE GROOVES, METHOD OF MAKING AND METHOD OF USING THE SAME**	

APPEAL REPLY BRIEF UNDER 37 C.F.R. §§41.41(a)(1)-(2)

Commissioner for Patents
Post Office Box 1450
Alexandria, Virginia 22313-1450

Sir:

Applicant respectfully requests the consideration of this Appeal Reply Brief pursuant to 35 U.S.C. §134 and 37 C.F.R. §§41.41(a)(1)-(2) responding to the Examiner's Answer mailed September 13, 2007 maintaining the rejection of claims 1-13 and 32.

APPEAL REPLY BRIEF UNDER 37 C.F.R. §§ 41.41(a)(1)-(2)

I. Real Party in Interest.

The Real Party in Interest is Intel Corporation, 2200 Mission College Blvd., Santa Clara, CA, assignee of the inventors' entire interest.

II. Related Appeals and Interferences.

None.

III. Status of the Claims.

Claims 1-13 and 32 stand finally rejected and are the subject of this Appeal. Claims 14-31 have been cancelled.

IV. Status of Amendments.

The Amendments submitted October 10, 2006 have been entered.

V. Summary of Claimed Subject Matter.

Embodiments of the invention relate to methods and devices that are capable of separating molecules from one another based, in part, on the physical size and shape of the molecules. The molecules having differing sizes and shapes are separated from one another by causing the molecules in solution to traverse a lengthy non-linear path. Molecules that are larger and more inconveniently shaped (i.e., molecules that have a larger effective diameter) will take longer to traverse the tortuous path than smaller molecules having sleek shapes that are capable of more readily moving with a solution flowing through the channel. Thus, allowing a solution-based sample comprising different molecules to traverse a tortuous route will cause the molecules to separate from one another and smaller molecules will emerge from the tortuous path more quickly than larger molecules.

Referring now to Figure 5 from the application (provided below), a non-linear path (shown as a line with arrows) is created by the placement of two substrates (10 and 20) having a plurality of channels (14 and 24, respectively) so that the channels 14 from the first substrate 10 are in fluid connection with the channels 24 from the second

substrate 20. Each channel of the first substrate 14 is misaligned relative to the channels 24 of the second substrate. With the application of a force, such as gravity, pressure, or an electric field, molecules within a solution are required to zigzag through a tortuous path created by the misaligned channels (14 and 24). These physical constrictions impart a sieving capability to the 2-substrate stack. The speed at which a particular molecule traverses from one end of the apparatus to the other depends upon the molecular weight and three-dimensional structure of the molecule (i.e., the effective diameter of the molecule).

FIG. 5

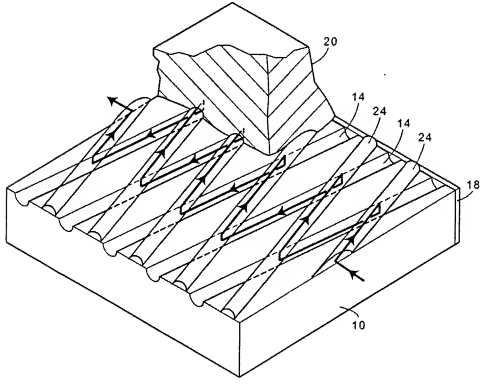

Table 1 provides a listing of independent claims and separately argued dependent claims. References to the specification are provided for the claims in Table 1.

Table 1

Claim	Specification Reference
1. An apparatus comprising first and second substrates, each of the substrates having a surface containing at least about 1000 open, nanoscale channels disposed therein, the surfaces bonded together such that each of the channels of the first substrate is in fluid communication with at least two of the channels of the second substrate and is misaligned relative to the channels of the second substrate; and wherein the fluid communication between channels creates a continuous nonlinear pathway for a fluid to flow alternatingly between the channels of the first substrate and the channels of the second substrate.	Figures 1-5, paragraphs [0015]-[0017], [0021]-[0022], [0029], and [0033]-[0039]
12. The apparatus of claim 11, wherein the third and fourth substrates comprise silicon oxynitride.	Figures 1-5, paragraphs [0015]-[0017], [0021]-[0022], [0029], and [0031]-[0039]
13. The apparatus of claim 1, wherein the channels of the first substrate are misaligned relative to the channels of the second substrate by an angle of about 0.05° to about 45°, the angle defined by an intersection of a channel of the first substrate and a channel of the second substrate.	Figures 1-5, paragraphs [0015]-[0017], [0021]-[0022], [0029], and [0033]-[0039]
32. The apparatus of claim 1 also including electrodes disposed such that the electrodes are capable of creating an electric field along a length of the path traveled by a liquid flowing through the continuous nonlinear pathway.	Figures 1-5, paragraphs [0015]-[0017], [0021]-[0022], [0029], [0032]-[0039]

VI. Grounds of Rejection to be Reviewed on Appeal.

The grounds of rejection for review are:

(1) claims 1-11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ramsey et al (US 2005/0103713),

(2) claims 12 and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ramsey et al (US 2005/0103713) and further in view of WO 96/12541 (WO'541), and

(3) claim 32 stands rejected under 35 U.S.C. §103(a) as being unpatenable over Ramsey et al (US 2005/0103713) and further in view of Swedberg et al. (US Pat. No. 5,571,410).

VII. Argument.

A. Rejections Under 35 U.S.C. §103(a) as Unpatentable over Ramsey et al.

i. Argument for claims 1-11

Claims 1-11 stand rejected over Ramsey et al (U.S. Application No. 2005/0103713) under 35 U.S.C. §103(a).

The present invention is not obvious over Ramsey et al. because Ramsey et al. fails to disclose all the elements of the claims. To establish a *prima facia* case of obviousness, the prior art reference must, *inter alia*, "teach or suggest all of the claim limitations." M.P.E.P. §2143 (Rev. 5, Aug. 2006). For example, Ramsey et al. fails to teach the creation of a non-linear path "wherein the fluid communication between channels creates a continuous nonlinear pathway for a fluid to flow alternatingly between the channels of the first substrate and the channels of the second substrate." Although the Examiner's Answer supplies Figure 17 from Ramsey, it fails to point out how the channels of Ramsey create a "**continuous non-linear pathway for fluids to flow alternatingly between the channels**." What Ramsey does disclose, is a cris-cross pattern of channels that is designed for a fluid injected into a first channel to stay in that channel, even where the first channel intersects a second perpendicular channel. The second channel of Ramsey is designed to be concurrently filled with fluid. If the

second channel were not filled with a second fluid stream, the fluid stream of the first channel would in part remain in the first channel, and in part flow into the second channel. In Ramsey, the fluid would not flow **alternatingly** between channels as in the present invention (see Figure 5 reproduced above), it would instead flow concurrently in all the channels. Thus, Ramsey does not teach or suggest a device that allows a fluid stream to flow **alternatingly** between channels in two different substrates. Thus because Ramsey et al. does not teach or suggest all of the claim limitations, claims 1-11 are not obvious over Ramsey et al.

Additionally, the final office action admits that "Ramsey does not teach the number of channels in the substrate." However, the office action argues, "the number of channels would depend on the functional requirements such as the number of samples to be treated, etc, and can be optimized. Discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art." (Final Office Action, mailed October 18, 2003, pp. 2-3) Merely taking the device of Ramsey and increasing the number of channels would **not** provide the molecular separation achieved by the device of the present invention. In Ramsey, the number of channels is not a variable that affects the ability of the device of Ramsey to separate molecules based on physical properties. "A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." M.P.E.P. §2144.05(II)(B) (Rev. 5, Aug. 2006) citing *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). Thus, because a number of channels is not a variable that affects the ability of the device of Ramsey to separate molecules, it would not be obvious to increase the number of channels for the device of Ramsey, and the present invention is not obvious over Ramsey et al.

B. Rejections Under 35 U.S.C. §103(a) as Unpatentable over Ramsey et al. in view of WO 96/12541

i. Argument for claims 12 and 13

Claims 12 and 13 stand rejected over Ramsey et al (U.S. Application No. 2005/0103713) in view of WO 96/12541 (WO'541) under 35 U.S.C. §103(a). The

final office action states that Claim 12 differs from the material for the third and fourth substrates, silicon oxynitride... and WO'541 teaches depositing silicon oxynitride." And "[w]ith respect to claim 13, the angle between the channels of the first and second substrate is only a dimensional issue... and it would be obvious to one of ordinary skill in the art... to use the teaching of WO'451 in the teaching of Ramsey because of the benefits afforded by the design of WO'451." (Final Office Action, mailed October 18, 2003, pp. 3-4.) However, to establish a *prima facia* case of obviousness, the prior art reference must, *inter alia*, "teach or suggest all of the claim limitations." M.P.E.P. §2143 (Rev. 5, Aug. 2006). For the reasons discussed above in Section VII(A)(i), Ramsey et al does not render the claim 1 obvious because it fails to teach all the claim limitations, i.e., that Ramsey et al fails to disclose "at least about 1000 open, nanoscale channels" and a device wherein "the fluid communication between channels creates a continuous nonlinear pathway for a fluid to flow alternatingly between the channels of the first substrate and the channels of the second substrate." The reference WO 96/12541 does not remedy this defect in that it also does not disclose these missing elements.

Additionally, WO 96/12541 does not teach a device that would work to separate a sample containing a plurality of molecules because it does not disclose nanochannels. As noted in the specification at [0015], "the term 'nanoscale channel' refers to any void space in a surface of a substrate having a diameter in at least one direction of about one to about 500 nm." A nanometer is 10^{-9} meters. In contrast, the channels shown in WO 96/12541 are microscale channels (10^{-6} meters). Microscale channels would be several orders of magnitude too large to perform the molecular sieving functions of the present invention. The design of the present invention creates a tortuous path through nanoscale channels on the molecular scale (nm), these nanometer scale physical constrictions impart molecular size-based sieving capacity.

The further limitation of claim 13, that "the channels of the first substrate are misaligned relative to the channels of the second substrate by an angle of about 0.05° to about 45°, the angle defined by an intersection of a channel of the first substrate and

a channel of the second substrate," is also not taught or suggested by the combination of Ramsey et al and WO 96/12541. Neither Ramsey et al nor WO 96/12541 teach or suggest a device capable of performing molecular separations for a sample containing three or more differently sized molecules, based on the effective diameter of the molecule. Therefore neither reference provides teaching or suggestion as to an effective geometry for the creation of a tortuous pathway for a sample volume to travel through a plurality of nanoscale channels.

Thus, because Ramsey et al and WO 96/12541 do not teach or suggest all of the claim limitations, these references do not render claims 12 and 13 obvious.

C. Rejections Under 35 U.S.C. §103(a) as Unpatentable over Ramsey et al. in view of Swedberg et al (US Pat. No. 5,571,410)

i. Argument for claim 32

Claim 32 stands rejected over Ramsey et al (U.S. Application No. 2005/0103713) in view of Swedberg et al (US Pat. No. 5,571,410) under 35 U.S.C. §103(a). The final office action states "using an electrode for sample transport and detection is know in the art as taught by Swedberg; one would use the teaching of Swedberg in the teaching of Ramsey for providing the motive force for a detector as taught by Swedberg." (Final Office Action, mailed October 18, 2003, p. 4.) However, to establish a *prima facia* case of obviousness, the prior art reference must, *inter alia*, "teach or suggest all of the claim limitations." M.P.E.P. §2143 (Rev. 5, Aug. 2006). For the reasons discussed above in Section VII(A)(i), Ramsey et al does not render the claim 1 obvious because it fails to teach all the claim limitations. Swedberg et al does not remedy this defect in that it also does not disclose these missing elements.

Thus, because Ramsey et al and Swedberg et al. do not teach or suggest all of the claim limitations, these references do not render claim 32 obvious.

For the foregoing reasons, the rejections of claims 1-13, and 32 should be reversed.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17, particularly, extension of time fees.

Respectfully submitted,

INTEL CORPORATION

Dated: November 13, 2007.

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Margaux Rodriguez *November 13, 2007*

VIII. Claims Appendix.

1. (Previously Presented) An apparatus comprising first and second substrates, each of the substrates having a surface containing at least about 1000 open, nanoscale channels disposed therein, the surfaces bonded together such that each of the channels of the first substrate is in fluid communication with at least two of the channels of the second substrate and is misaligned relative to the channels of the second substrate; and wherein the fluid communication between channels creates a continuous nonlinear pathway for a fluid to flow alternatingly between the channels of the first substrate and the channels of the second substrate.

2. (Previously Presented) The apparatus of claim 1, wherein the channels have equivalent and constant cross-sectional areas within a range of about 1 square nanometers (nm^2) to about 10,000 nm^2.

3. (Previously Presented) The apparatus of claim 1, wherein the channels have equivalent and variable cross-sectional areas within a range of about 1 nm^2 to about 10,000 nm^2.

4. (Original) The apparatus of claim 1, wherein each of said surfaces has at least about 1000 channels to about ten million channels disposed therein.

5. (Original) The apparatus of claim 1, wherein each of the channels traverses an entire length of the surface.

6. (Original) The apparatus of claim 1, wherein the channels of the first substrate are parallel to each other, and the channels of the second substrate are parallel to each other.

7. (Original) The apparatus of claim 1, wherein the channels of the first substrate are spaced equidistant from each other, and the channels of the second substrate are spaced equidistant from each other.

8. (Original) The apparatus of claim 1, wherein the first and second substrates comprise one or more materials selected from the group consisting of quartz, silica, silicon, porous silicon, polysilicon, and porous polysilicon.

9. (Original) The apparatus of claim 8, wherein the first and second substrates comprise quartz.

10. (Original) The apparatus of claim 1, further comprising third and fourth substrates bonded to edge surfaces of each of the first and second substrates, the edge surfaces being substantially perpendicular to the channels.

11. (Original) The apparatus of claim 10, wherein the third and fourth substrates comprise one or more materials selected from the group consisting of quartz, silica, silicon, porous silicon, polysilicon, porous polysilicon, and silicon oxynitride.

12. (Original) The apparatus of claim 11, wherein the third and fourth substrates comprise silicon oxynitride.

13. (Original) The apparatus of claim 1, wherein the channels of the first substrate are misaligned relative to the channels of the second substrate by an angle of about 0.05° to about 45°, the angle defined by an intersection of a channel of the first substrate and a channel of the second substrate.

Claims 14-31 canceled.

32. (Previously Presented) The apparatus of claim 1 also including electrodes disposed such that the electrodes are capable of creating an electric field along a length of the path traveled by a liquid flowing through the continuous nonlinear pathway.